SUMMER INTERNSHIP REPORT

at

Ernst & Young – India EYLLP

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A Report

By

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Acknowledgements

“Without the help and support of others, it is impossible to create a project report. Certainly this one's no exception.”

At the opening of this report, we would like to express our profound gratitude to everyone who has supported us in this endeavour. We would not have advanced the project without their proactive counsel, assistance, cooperation, and encouragement. We owe a debt of gratitude that cannot be adequately expressed to our Manager, Sagar S. Bele, Senior Consultant, Kavitha Subramani, and Senior Consultant, Anurag Deb for their diligent direction and encouragement in helping us complete this task.

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Thanking You,

Sudhanshu Batra

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Abbreviations

Abbreviation	Full form
ABDM	Ayushman Bharat Digital Mission
ABHA	Ayushman Bharat Health Account
ANM	Auxiliary Nurse Midwifery
ASHA	Accredited Social Health Activist
CBAC	Community Based Assessment Checklist
CHO	Community Health officer
CPHC	Comprehensive Primary Healthcare
DGHS	Directorate General of Health Services
DLC	Digital Lifecare
FHIR	Fast Healthcare Interoperability Resources
GoI	Government of India
HFR	Health Facility Registry
HIE-CM	Health Information Exchange & Consent Manager
HIP	Health Information Provider
HIU	Health Information User
HPR	Health Professionals Registry
HRP	Health Repository Provider
JSON	JavaScript Object Notation
MO	Medical Officer
MoHFW	Ministry of Health & Family Welfare
NCD	Non-Communicable Diseases
NDHM	National Digital Health Mission
NHA	National Health Authority
PHR	Personal Health Record

Observational learning

Introduction: -

Ernst & Young Global Limited is a multinational professional services network with headquarters in London, England. EY is one of the largest professional services networks in the world. Along

with Deloitte, KPMG , and PricewaterhouseCoopers, it is considered one of the Big Four accounting firms. Like many of the larger accounting firms in recent years, EY has expanded into markets adjacent to accounting, including strategy, operations, HR, technology, and financial services consulting.

EY operates as a network of member firms that are structured as separate legal entities in a partnership, and has 312,250 employees in over 700 offices in more than 150 countries around the world. The firm's current partnership was formed in 1989 by a merger of two accounting firms; Ernst & Whinney and Arthur Young & Co. In 2019, EY was the seventh-largest privately owned organization in the United States.

Over the course of the last decade, EY has substantially altered its business approach to offer a more comprehensive scope of services. According to the latest published data, the company has the following four main service lines:

- Assurance: comprises Financial Audit, Financial Accounting Advisory Services, CCaSS (Climate Change and Sustainability services), and Forensic & Integrity Services.
- Tax: Transfer Pricing, International Tax Services, Business Tax Compliance, Global Trade, Indirect Tax, Tax Accounting & Risk Advisory Services, Tax Technology and Transformation, Transaction Tax.
- **Consulting**: comprises three sub-service lines – Business Consulting, **Technology Consulting**, and People Advisory Services.
- Strategy and Transactions or SaT: deals with companies' capital transformation – including Business Valuation and Economics, Due Diligence, Real Estate Advisory, M&A, Restructuring (financial and operational), Corporate Finance Strategy.

Objectives :-

The need for better digital citizen experiences is driving greater expectations for improved online public services and personalization. Digital transformation has become an imperative in the digital age.
Digital technologies and social media are changing how governments and citizens engage with one another. COVID-19 has added extra pressure on governments to streamline their online approach. As a result, there is a need for a digital government that can help governments provide better public services to citizens and businesses.

Governments are asking EY to help them develop effective strategies, understand their target audiences and expectations, manage change and execute information technology development and implementation.

GPS is currently the second largest sector within Consulting worldwide with an active global network, strong local DNA, and a passion for serving those who serve their nation.

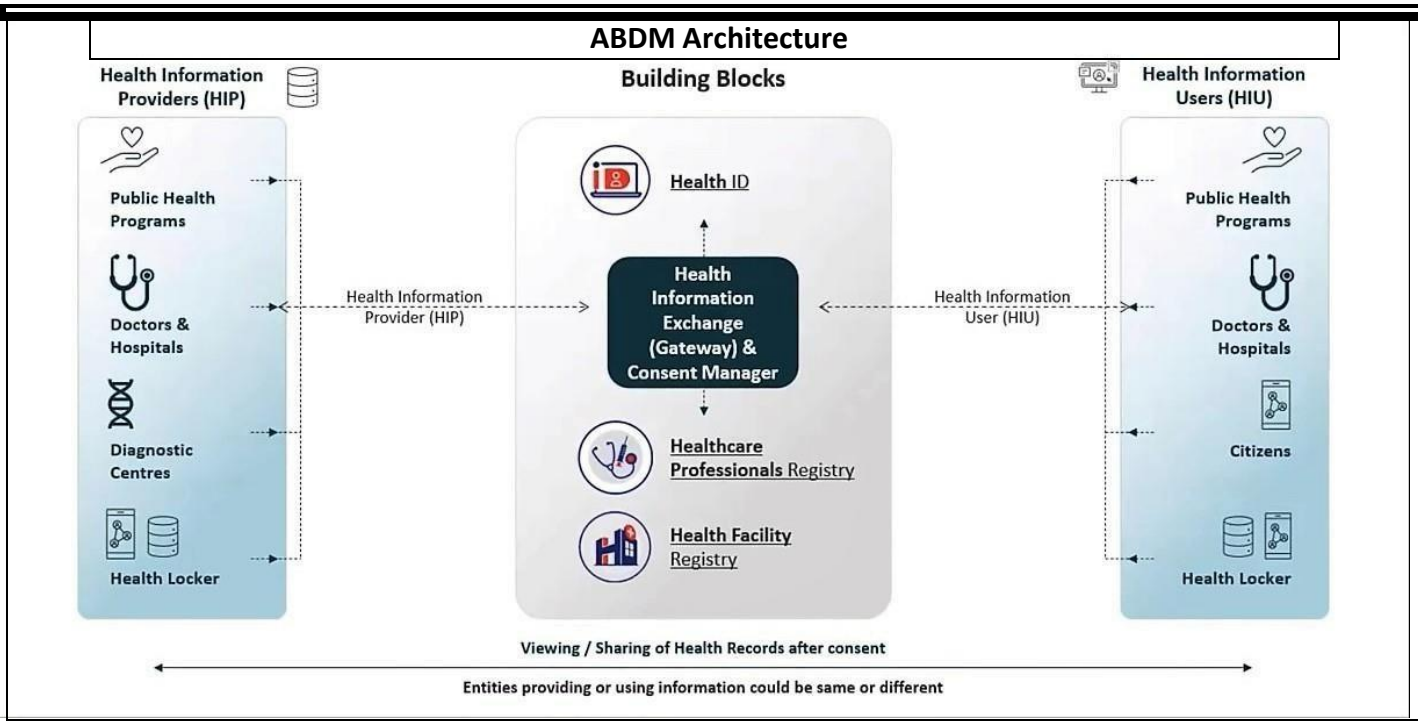
EY makes an impact through building trusted relationships with our clients, with a focus on large transformational projects, innovative solutions, and the collective leverage of a globally connected practice.

General Findings:-

On 15th August 2020, the Hon'ble Prime Minister announced the National Digital Health Mission (NDHM) following which the NDHM pilot was launched in all the Union Territories. Later, on 27th September 2021, there was a nationwide rollout of a pilot project called Ayushman Bharat Digital Mission (ABDM). ABDM was launched by GoI for promoting the digitization of healthcare and creating an open interoperable digital health ecosystem for the country. It aims to do so by:

- Common health data standards (FHIR), &
- Registry of Health Facilities (HFR), Healthcare professionals (HPR), etc.,

The Ayushman Bharat Digital Mission aims to develop the backbone necessary to support the integrated digital health infrastructure of the country. ABDM seeks to bridge the gap among multiple stakeholders as part of the healthcare ecosystem.



ABDM Sandbox Integration and Exit process

The Ayushman Bharat Digital Mission has developed building blocks and APIs to offer a seamless digital healthcare experience for all stakeholders – health facilities, patients, and healthcare workers. The digital infrastructure developed is now accessible to health facilities and health tech players for integration. Sandbox is a framework that permits technologies and product testing in a contained environment. Anyone who wishes to develop software services and products linked with ABDM services can benefit from the hosting of the following building blocks in sandbox services:

- ABHA number services
- Consent Manager and Gateway
- Sandbox ABHA Mobile Application for Android
- Sandbox HIU application
- Sandbox DigiDoctor
- Sandbox Health Facility

The integration process is distributed in phases termed Milestones. Three milestones are recommended to develop the end-state patient experience:

Milestone I: ABHA number creation and capture and verification for seamless patient registration

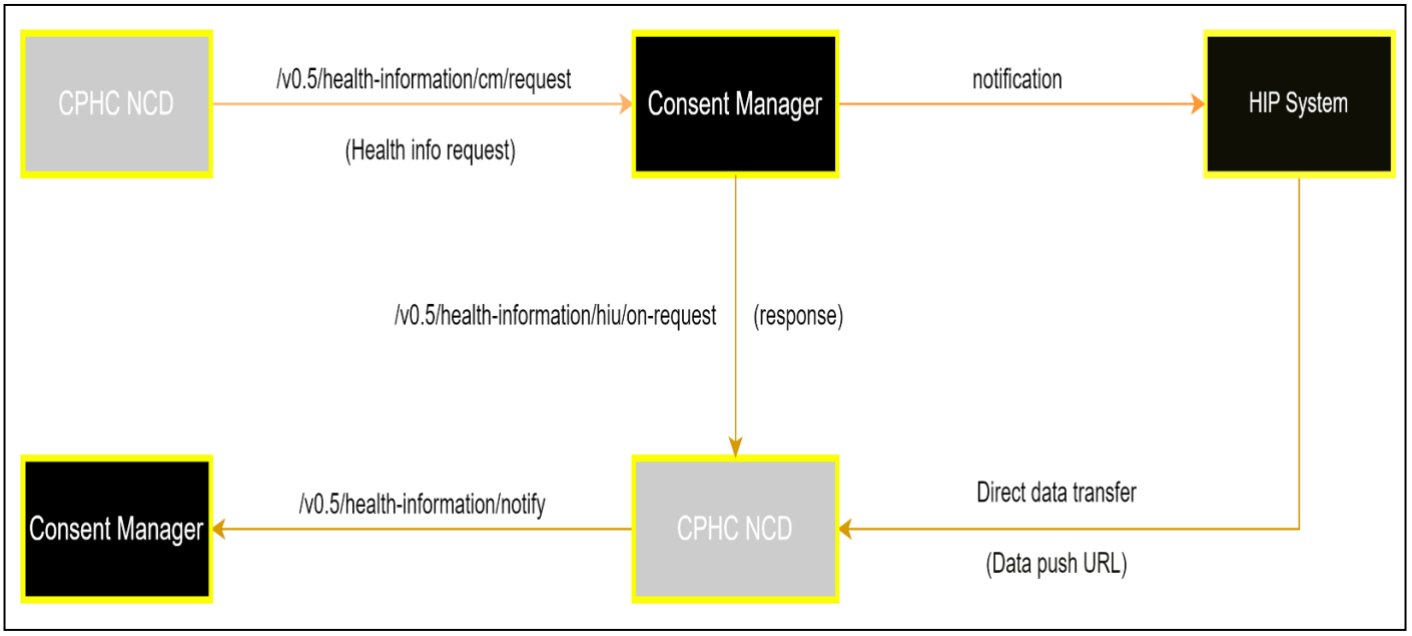
Milestone II: Building HIP services to share digital records via Personal Health Records (PHR/ABHA) app.

Milestone III: Developing HIU services to provide a few of the patient's medical history to authorized healthcare workers with complete consent.

The first step to integrating with h the ABDM ecosystem is to register on Sandbox.

HIE-CM

A health information exchange and consent manager is an entity that enables consent management and sharing and linking of PHRs for a user. ABDM's own HIE-CM lies in the PHR app where the user can sign up with a health ID. Health Data Consent Manager (HDCM) plays the role of fiduciary or trustee with which a patient signs up, to begin with.



Healthcare IT Standards – FHIR

In healthcare information technology, standards provide a common language and set of expectations that enable interoperability between systems and/or devices.

Interoperability is the capacity of two or more systems or components to share information and make use of that information, according to the IEEE Standards Computer Dictionary. For a standard to be successful it should have the following:

1. High Rate of Adoption
2. Consumer Demand

- Meets the user base
- Well documented
- Easy to use
- Inexpensive (or FREE!)

3. Government Required

“Fast Healthcare Interoperability Resources”

It is a new standard that leverages web-friendly formats that enables the interchange and comprehension of health data among applications and businesses.

The most recent healthcare IT standard, FHIR, was developed by HL7 International and is now being used all over the world. Health Level Seven International (HL7), a not-for-profit, ANSI-accredited standards development organization, was established in 1987 to provide a thorough framework and related standards for the exchange, integration, sharing, and retrieval of electronic health information that will support clinical practice and the administration, provision, and evaluation of healthcare services.

Ayushman Bharat digital mission has chosen FHIR R4 as the mode of data exchange standard, where R4 represents version 4.

All of the platform's parameters were identified to make the NCD portal ABDM compliant, and they were subsequently mapped with the FHIR label to convert the data format that ABDM supports. Following that, the data format is placed in resource bundles known as care contexts.

The FHIR implementation guide for ABDM Health Data Interchange Specifications 1.0, which is based on FHIR R4 and sets basic conformance requirements for accessing health data to achieve continuity of care in the Indian setting, was created by NRCes (National Resource Center for EHR Standards).

This implementation guide's goal is to outline the minimal and necessary health record artifacts that can be shared by the ABDM Health Data Interchange Specifications 1.0.

The implementation of ABDM as contemplated by NDHB is referred to in this guide as well as other guidelines, such as EHR standards for India (2016), Medical Council of India (MCI), and Pharmacy Council of India (PCI).

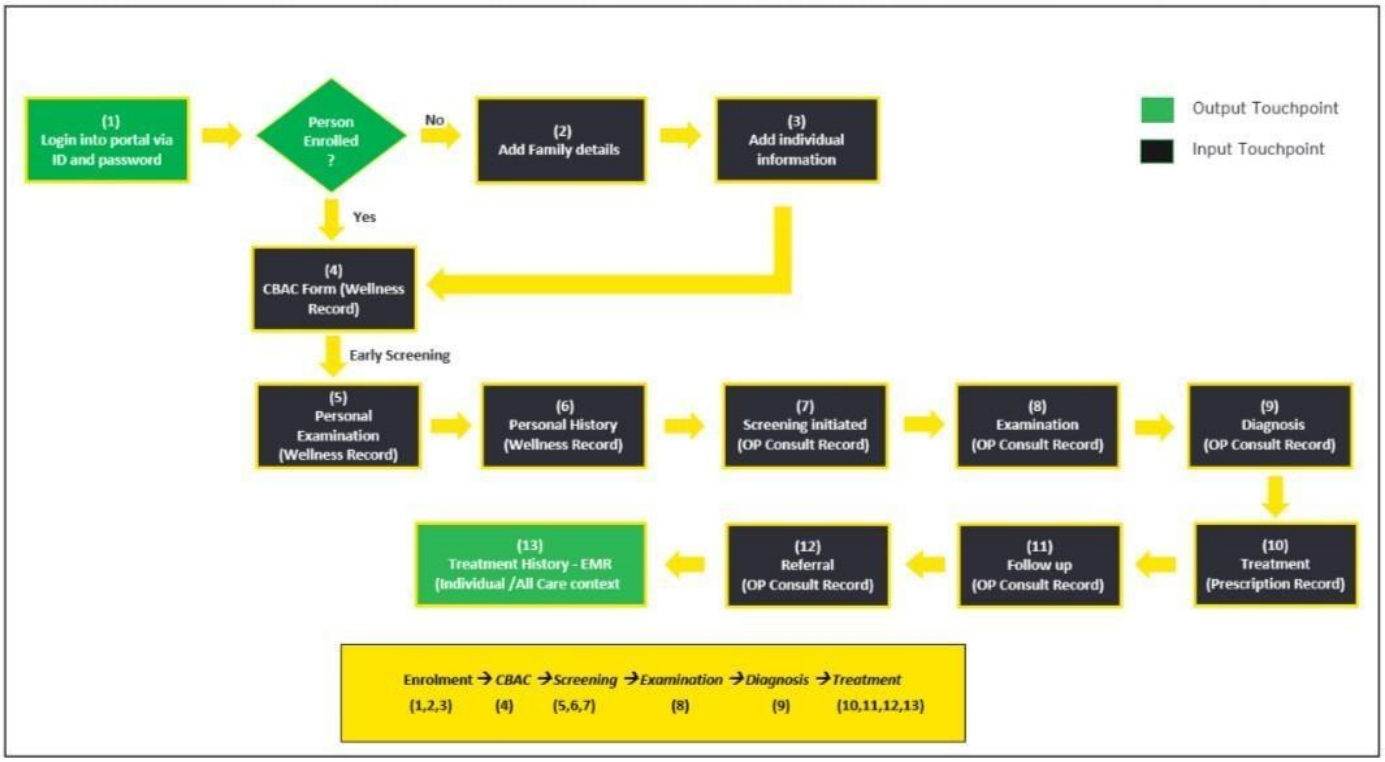
ABDM profiles

The following is a list of profiles that define the minimum mandatory elements and terminology requirements that must be present.

1. **Wellness Record**
2. **OP Consult Record**
3. **Prescription Record**
4. **Immunization Record**
5. **Diagnostic Report Record**
6. **Discharge Summary Record**
7. **Health Document Record**

CPHC-NCD Platform

- Understanding the CPHC-NCD platform and creating an end-to-end workflow:



Non-communicable diseases (NCDs) are "silent" illnesses with few or no early signs, making diagnosing those with them challenging. Better health outcomes, higher survival rates, and reduced personal expenses result from screening for NCDs and managing them early. As a result, screening them as soon as possible is critical so that they can be accurately diagnosed, treated, and given preventative care to maintain their health.

The DLC (Digital Lifecare Platform) makes it possible for registered health workers to screen adults over 30. The platform is capable of carrying out several tasks, including Enrolment, Screening, managing referrals, and storing relevant medical records. Below is a detailed explanation of each: -

- **Enrolment-** An ASHA employee conducts enrolment; the person is enrolled with their demographic, lifestyle, and insurance details. Additionally, accurate records of personal data are recorded. If the citizen is already registered, ASHA will search for him or her and conduct additional risk assessments.
- **CBAC-** ASHA is also in charge of completing the CBAC form (Community Based Assessment Checklist). The CBAC form is used to record signs and symptoms for risk assessment and to aid in early screening of the individual, after which the screening process begins. ASHA refers to the ANM for further evaluation.

- **Screening** – Screening is handled by ANM. You must first complete the CBAC and Personal Examination to begin the screening process. Screening is done for high blood pressure, diabetes, oral cancer, cervical cancer, and breast cancer. At the sub-center, ANM performs a personal examination (vitals are taken) and personal history. ANM also takes blood pressure and sugar levels and performs a visual examination in the field. The ANM then refers patients to a PHC or a higher-level facility (CHC, DH, TCC) as per their condition.
- **Examination** – MO/CHO at PHC level further examines the patient physically to diagnose thecondition.
- **Diagnosis** – Diagnosis is made for the patient according to the understanding of the practitioner. NCD recommends action for diagnosis according to the information provided. The practitioner could either proceed with that or override the suggestion.
- **Treatment** – Treatment is done via Counselling and Medication advice. Follow-up is conducted. The patient is referred further in case special care is required. We get the treatment history as an EMR (Electronic Medical Record) at the end of the process. Investigation Report includes ordering test for a particular condition if required and the result is updated in the work plan section (Pending investigation) with the report file. Drugs can also be tracked for the quantity and the name of the drug being issued.

*To protect the client's confidentiality, we are not permitted to share the following corresponding files of the deliverables mentioned below: -

- Identification of entry and exit touchpoints -
- Documentation of the APIs (Application Program Interface) involved in the workflow- API (Application Program Interface) facilitates communication between two programs or applications. Hence, for the implementation, it is important to keep track of the existing APIs.
- Identification of the Parameters of the platform – We mapped the parameters of the platform with the UI (User Interface) of the application by extracting it from the GET JSON (JavaScript Object Notation) response.
- Creation of business process flows, which is a flowchart or diagram that illustrates each step of a process, including what tasks are performed, using diagrams.net.
- Creation of use case diagrams, which describe the high-level functions and scope of a system or simply put, it identifies the interactions between the system and its actors.
- Project management involves the planning and organization of the company's resources to move the specific project towards completion.
- Documentation on “Requirements for CPHC-NCD certification for Milestone 2 & 3 on ABDM sandbox” via Inception report, Software Requirements Document (SRS), Functional Requirements Document (FRS), and Business Requirement Document (BRD).

Inception Report:

The final report, which is written after the project is over, is based on the inception report. The project evaluation deadlines, benchmarks, and techniques are outlined in the inception report. Measures chosen during the project's conception and before to execution can be used by evaluators to gauge results.

Software Requirement Specifications (SRS):

The most crucial document in the software development process is the software requirements specification. Both the foundation for development and validation are provided by it.

All criteria must be adequately defined in the SRS without mentioning implementation or project management concerns.

The SRS needs to be finished as soon as possible during development. Despite the fact that changes will probably happen during the development life cycle, the SRS should have all the data required to move forward into the design phase.

Functional Requirement Specifications (FRS):

The product to be offered is described in terms of the functions it will carry out and the facilities needed to satisfy the user needs in the functional requirements specification.

1. Detailed information about each screen's activities

2. The system should be programmed using data handling logic.

3. It needs to describe system reports or other outputs.

Business Requirement Document (BRD):

A Business Requirements Document is a formal report that outlines all the goals or "requirements" for a new project, programme, or business solution. It outlines a business need or goal as well as what is anticipated moving forward with the project.

Benefits of BRD include:

• Reducing project failure due to misaligned or misrepresented requirements;

• Connecting to larger business goals and monitoring overall project health;

• Fostering consensus and teamwork among stakeholders and team members; and

• Saving money on change requests, infrastructure, training, and other costs.

Conclusive Learning:

- Internships at EYLLP have empowered us to hone our interpersonal skills while also providing us with exposure to the fundamentals of ABDM.
- Working as a Technology Consultant taught us how to interact with clients and understand their needs. We also learned how to accept and handle feedback constructively while meeting deadlines. Overall, we received a lot of exposure in the organization.

Limitations:

- Due to time constraints, we were not able to have interviews with the other departments of the organization
- Participants are taken from the same organization to protect the confidentiality of the data
- Sample's readiness in participation due to their busy work schedule
- Sample is taken by the method of convenient sampling
- As interviews were conducted for the collection of data, the chances of omitting the original phrases of the participants

Project Report

Topic: Enabling health entities to become ABDM compliant: What are the challenges faced in the digitalization of the Health Ecosystem?

Introduction

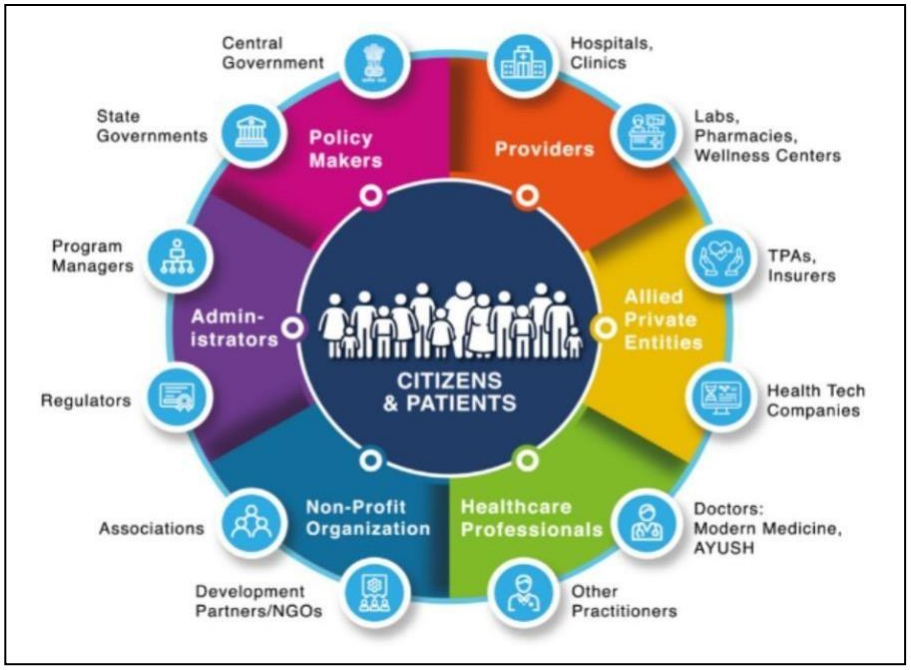
The Ayushman Bharat Digital Mission (ABDM) aims to build the framework needed to sustain the nation's integrated digital health infrastructure. Through digitalization, it hopes to bridge the gap between the various stakeholders in the healthcare ecosystem.

As part of this initiative, all Indians will receive digital health IDs, which will allow hospitals, insurance companies, and individuals to electronically access medical records as needed.

The implementing agency will be the National Health Authority (NHA), which is part of the Ministry of Health and Family Welfare.

Its vision is to create a national digital health ecosystem that is effective, affordable, accessible, inclusive, and safe while supporting universal health coverage. This ecosystem should also provide a variety of data, information, and infrastructure services while utilising open, interoperable, standards-based digital systems and ensuring the security, confidentiality, and privacy of personal health information.

ABDM Ecosystem:



Benefits:

1. Make it simple for medical professionals, institutions, and service providers to conduct business.

2. With consent, make longitudinal health records of citizens accessible and exchangeable.

3. The objective will increase "equitable access" to high-quality healthcare by promoting the use of telemedicine and other technologies and making health services portable across national borders.

Every Benefit comes with certain concerns as well, so the major concerns are: -

1. The misuse of data by private companies and undesirable actors may result from the absence of data protection legislation.

2. Concerns also exist over the exclusion of citizens and the denial of healthcare as a result of systemic flaws.

ABDM Building Blocks:

ABHA number:

Any participant in India's digital healthcare ecosystem would be uniquely identified by their **14-digit ABHA number**. ABHA number will establish a strong and trustable identity for you that will be accepted by healthcare providers and payers across the country

The ABHA number will be utilized to authenticate individuals, identify them specifically, and connect their health records across various systems and stakeholders (but only with the patient's informed consent).

Health facility registry: - The Health Facility Registry is a comprehensive database of healthcare facilities across both traditional and advanced medical systems. It consists of both governmental and private health facilities, such as clinics, hospitals, diagnostic centers, imaging centers, and pharmacies.

ABHA app (PHR):

A PHR is an electronic record of a person's health-related data that complies with nationally accepted interoperability standards, may be obtained from various sources, and is managed, shared, and controlled by the person.

The PHR's most notable characteristic, which sets it apart from the EMR and EHR, is that the information it contains is in the person's hands.

An individual will be able to handle information about his or her medical care thanks to the features enabled by a personal health record system (PHR). Viewing a longitudinal record that contains all health information, lab results, treatment information, and discharge summaries from one or more healthcare facilities is part of this.

Healthcare Professional Registry: - The Health Professional Registry (HPR) is a comprehensive database of all healthcare providers working in both modern and conventional medical systems. A key component of the Ayushman Bharat Digital Mission is HPR (ABDM).

Key features of the ABHA mobile application are: -

- Creation of ABHA Address
- Discovery of Health Information
- Linking of health records/ with a given ABHA Address
- View Health Records
- Management of consents

Adopting technologies to enhance workflows, efficiency, and patient care is what digital transformation actually involves. EHRs, telehealth applications, and cloud security technology all aid in the digital transformation. The infrastructure of the digital healthcare ecosystem facilitates the transition from an organization-centered healthcare model to a patient-centered model. The primary goal of this system is to provide collaborative and multidisciplinary health services. This means that several care systems collaborate to provide patient care. In addition to providing treatment, being patient-centered entails addressing wellness and prevention. The ecosystem of digital health services investigates the physical, mental, and spiritual determinants of social health. The goal of launching ABDM is to build a national digital health ecosystem that supports universal health coverage and a seamless online platform in an effective, accessible, inclusive, affordable, timely, and safe manner by providing a variety of data, information, and infrastructure services, appropriately leveraging open,

interoperable, standards-based digital systems, and ensuring the security, confidentiality, and privacy of health-related personal information. (1). But there are operational areas that need capacity building without which the exercise might prove costly in terms of acceptance, usability, and data aggregation (2).

Undoubtedly, the present coronavirus disease 2019 (COVID-19) pandemic poses a serious threat to traditional medical services. The need for modifying and modernising clinical care delivery systems has been underlined by COVID-19. It has done a great job of emphasising the need to modify and modernise clinical care delivery systems. (3).

The involvement of several stakeholders, such as patients, clinicians, the insurance industry, and regulators in medicine, is still relatively low despite the rapid expansion of digital technologies.

The rationale of the Study

In National Health Policy 2017 the National Digital Health Mission was envisaged to cater to the need of making the healthcare ecosystem a digital one. As per other studies implementation of digital health is a major concern since, health is a state matter, with the states responsible for on-the-ground implementation while policy directions are centrally directed, making implementing digital health throughout India one of the biggest challenges. As a result, individual states are legally permitted to deviate from central health directives.

The need for this study arises from the challenges we faced when working on the project to make the CPHC-NCD platform ABDM compliant. Also, this study will be beneficial for the entities who are/will undergo becoming ABDM compliant to develop an understanding of how it can be done. Therefore, this study is done to help assess the other challenges perceived by the implementers who are the domain experts to understand the in-depth issues faced by them and the necessity of a trained healthcare information technology workforce to enable handshaking between Health and IT.

Aim

The purpose of this study is to conduct interview-based qualitative research to explore the challenges faced by the implementers in integrating entities into the ABDM ecosystem.

Objectives

Primary objective:

1. To gain an understanding of ABDM and find out the challenges faced in the digitalization of the health ecosystem

Secondary objectives:

2. To find out the benefits of ABDM in the Public health sector.
3. To find out the areas of challenge in FHIR implementation.
4. To find out the underlying issues in the digitalization of rural India

Methodology

Study Sample - This is a Qualitative cross-sectional study orchestrated in May. A sample size of 10 was taken by the method of convenient sampling.
Employees of EY having experience in Digital health projects were included in the Inclusion criterion and the exclusion criteria involves any person that refused to participate in the study was excluded.

Tool of Data Collection – Here, open-ended questions are employed in a structured interview survey (the Performa of which is attached below in Annexure A). Then, in May 2022, data collection with informed consent was carried out, correlating the time of a summer internship.

The informed consent, data confidentiality, and personal privacy research ethical norms were adhered to. The predicted results of this study are that we will have a deeper grasp of the subject of ABDM and identify the difficulties and problems encountered during the digitization of the Indian healthcare system.

Analysis

The protocols were completely anonymised throughout, and all ten interviews were audiotaped and verbatim transcribed. Four members of our research team each with different disciplinary backgrounds in Pharmacy, Microbiology, Biomedical Sciences, and Healthcare Management, evaluated and discussed the transcripts. The coders followed the guidelines for assessing qualitative research. According to our predetermined objectives, the data were regularly coded, moving from coding at a more detailed level to coding at an abstract level that extracts significant themes from the data and looks for repeating concepts. These common codes were then clubbed into relevant themes. All findings were scrutinized and tested by our research team. Any disagreements were resolved by deliberation.

Results

The characteristics of the 10 respondents comprising the interview sample are summarized in **Annexure B**.

From the samples of data collected we could analyze the following statements:

- 7 out of 10 people feel that digital transformation is very essential in improving the efficiency of Healthcare in the era of several healthcare issues. Thus, the digitalization of the healthcare sector would help India in achieving Universal Health Coverage.
- Every Individual in our survey has a similar opinion on ABHA number that it is important to access all the information from admission to treatment and discharge in a paperless manner as well as to access health data and also access medical records such as lab reports, prescriptions, and diagnoses at his convenience.
- 6 out of 10 people in our survey said that by achieving the 3 milestones (Any Entity must be able to generate and verify health IDs, Building HIP to share digital records via PHR app, and Building HIU to provide a view of patient's medical history) an entity can become ABDM compliant.
- 8 out of 10 people in our survey felt that it is one of the best initiatives taken by the Government of India because one doesn't have to sit in and carry files for the health records (to provide seamless data integration across all systems, improvement in decision making as well as better compatibility in addition to quicker and more reliable information). Also if a patient loses any of his prescriptions over time, since everything is digitalized onto one platform, even after years, people and doctors can access the health records of a person properly and systematically.
- Every Individual in our survey has a similar opinion regarding the potential challenges faced in the digitization of rural India such as hesitance to acceptance of digitization, poor infrastructure, limited access to the internet, lack of coordination among various departments, and lack of awareness. Another major challenge would be because we wouldn't be finding a technically literate population in rural areas which remains a big challenge as ASHA, ANM, and MO should also understand the technology and should be able to use it properly.

The findings were organized around 9 main themes, each with its subthemes (**Annexure C** presents a summary of the themes).

Achieving Universal Health coverage

Upon being asked about the necessity of digitalization of the healthcare ecosystem, **P9** stated that "Because the administration of medical records in India is as disjointed and ineffective as the industry itself. Between facilities in the private and public sectors, there are also significant technological and procedural differences. So, digitalization of the sector would help solve most of these aspects and help India achieve Universal Health Coverage."

Benefits of having ABHA ID

When asked about the benefits of the ABHA address to the citizens of India **P4**, stated that "It can be used to link the user's medical records, including doctor prescriptions, lab reports as well as hospital records, etc. It can also link all health care benefits ranging from public health programs to insurance schemes to their unique ABHA number. To add to this Health records will only be shared after the consent of the citizen, hence it is also secure and confidential. A citizen can also withdraw their participation from ABDM if he wishes to discontinue due to any personal reason, it's all open to the citizens of India."

ABDM Compliance

On the topic of requirements for becoming ABDM compliant, **P5** had to say "The entity needs to achieve three milestones laid down by the NHA, called Milestone 1, 2, and 3, which mean that the entity should be able to generate and verify health IDs, implement HIP services, i.e., respond to consented data requests with data in FHIR format, as well as implement HIU services to display medical history with consent."

Benefits of ABDM to Public health stakeholders

P1 shared that "As ABDM aims to bridge the existing gap amongst different stakeholders of the healthcare ecosystem, Government policymakers can make better administrative decisions based on the collected medical data and inputs from medical researchers on said data to improve healthcare services." to describe how public health could be benefitted by the digitalization of ABDM.

Universal healthcare standard for data exchange

When questioned on the requirement for a global healthcare data sharing standard, "Because standards—the ability of healthcare systems to share medical data regardless of domain or software provider—are the basis for interoperability in the industry" —**P10** emphasized this point.

FHIR as the interoperability standard

P6, a senior consultant, highlighted "FHIR, every resource is connected with a unique identifier in response to a question regarding the usage of FHIR as an interoperability standard. Like how URLs make it possible to search for certain websites using any web browser or device, FHIR makes it possible and simple to get the proper collection of data from any device or application. FHIR reduces and shortens the time-consuming process of sending data back and forth between systems by simply assigning standard URLs for various data packets"

Issues in FHIR implementation

When asked about the **issues being faced upon implementing FHIR** as a mode of health data exchange standard **P7** stated that "I believe that the fact that the data might not always be the same is the fundamental problem with FHIR implementation. Consider lab reports as an example. It is almost difficult to provide a specific language for a vendor-EHR without a standard matching technology. This makes data matching much more difficult."

"The challenge with implementing a fantastic standard like FHIR, which has a broad reach, for a well-known and sizable firm is frequently connecting your current domain to the principles of the standard. The internal domain model will not be the same as the standard that the firms are attempting to embrace.

Likewise, several healthcare organizations have invested millions in assets and financing to support their further development" stated **P8.**

Challenges in implementation of ABDM compliance

P9 a senior consultant, having good experience in the hospital as well, mentioned that "Actually the HIS system in our hospital was still in the budding states. Like it was upgrading continuously. So somehow, I feel we still don't have a perfect HIS system for the hospitals. I wish we get a very nice HIS system, which could be used throughout the country. Also, you know, probably the government of India can do something like that as the next project. So that was a challenge where there were a lot of technical issues as to user rights. There was another issue in which users want rights to be given because there are a lot of legalities involved, right when it comes to the medical field. So, all that they had to kind of rework and do it, you know, what a nurse could see now, for example, what a person who's in the operations could see what a billing person could see, you know, things like that. Hence, we need to have those standards which are transparent and universal in every hospital" when asked about the challenges in the ABDM implementation from the hospital point of view.

Challenges in digitalization of rural India

P10 stated "Firstly, what strikes me is that the Lack of awareness and acceptance of digitalization could be the major issues. Another challenge would be because we would not be finding most of the population to be technically unsound, that remains a big challenge. Even the healthcare professionals such as ASHA, ANM, and MO should also understand the technology and should be able to use it in a proper manner" when asked about the challenges in the digitalization of healthcare in rural India.

Discussion

The effective delivery of healthcare to their customers and the country's population is ensured by digitalization, which appreciates India in a true sense as a "Digital Nation(4)**.** The analysis of the data revealed that almost all of our study participants feel that the digitalization of the healthcare ecosystem is of utmost importance, the reason being the overall improvement in the efficiency of the sector which shall ultimately lead India towards Universal Health Coverage. It was also found that having a unique Health (ABHA) ID can be useful for several things such as linking the user's medical records into one place (PHR App) which can later be accessed anytime by the patient himself or a Health Information User (Hospital, Insurers, Medical Researchers, etc as per request).

For an entity to become ABDM compliant, the entity needs to achieve three milestones laid down by the NHA, called Milestone 1, 2, and 3, which means that the entity should be able to generate and verify health IDs, implement HIP services, i.e., respond to consented data requests with data in FHIR format, as well as implement HI services to display medical history with consent.

By sharing an integrated information architecture where data is gathered and used for many purposes, clinical and patient safety systems can more efficiently address the wide variety of data collection and reporting needs. This is made possible by shared standards. Common data standards enable the quick integration of new knowledge into decision support systems, such as an alert of a new drug contraindication, and enhancements to the healthcare process.(5)**.**

To accomplish interoperability, the HL7 Fast Health Interoperability Resources (FHIR) employs a new strategy. The HL7 FHIR [23] standard adopts a modular approach in place of the conventional document-centric one and expresses the atomic/granular healthcare data (such as heart rate, procedure, medicine, allergies, etc.) as separate modular entities called Resources. These FHIR resources are controlled through APIs and RESTful web services, the cornerstone of modern web applications (created, updated, and shared). The HL7 FHIR standard was developed using the lightweight HTTP-based REST protocol, JSON, RDF, and other cutting-edge online and mobile technologies, as well as lessons learned from the inadequacies of earlier HL7 standards and models.(6).

The interoperability problems with clinical data are thought to have a solution, and FHIR is regarded as a special conduit that can provide it. However, several studies show that FHIR also encounters several challenges, including standard complexity and issues with implementation, acceptance, maintenance, and mapping. Accessing private health information saved in the cloud presents difficulties for the RESTful API that distinguishes FHIR from other standards(7)**.**

Lastly, when it comes to the overall implementation of ABDM compliance for any entity, there are several aspects to be considered and multiple facets of challenges and difficulties need to be overcome, especially concerning the ones related to rural India.

Conclusion

Our qualitative interview study with some of the implementers of digital Governance in Ernst & Young indicates that they are facing multiple challenges during the execution of enabling entities in becoming Ayushman Bharat Digital Mission compliant. One of the main difficulties identified from our study was that there are no 360 degrees of knowledge available about the same on the sandbox website by NHA for which one must go through all the webinars by NHA accompanied by other stakeholders thoroughly, to understand it completely first, which is a cumbersome task. Second, one must wait for NHA's input, which is yet another complex and time-consuming process, to have any key implementation-related queries resolved.

Hence, the objective of our study is accomplished as we got valuable insights from the results obtained on the challenges faced in the digitalization of the ecosystem.

However, the Ayushman Bharat Digital Mission is a great initiative by the Indian government to securely keep all the information in one location and share it with reliable doctors. The intriguing gap between stakeholders will be filled. Every Indian will receive a Unique Health ID that will be used to maintain their medical history, including summaries of their prescriptions, treatments, diagnostic reports, and discharges. When they visit a hospital for a consultation, patients will be able to grant their doctors and other healthcare professionals one-time access via consent to their data.

Recommendations

1. There must be more institutions in India that provide training and construct the necessary skill required for the growth of digital healthcare. Hence, capacity building is essential.
2. To ensure a successful implementation process in India, a middleman between public health domain experts and IT experts is required.
3. There is a need for more detailed and clear documentation for the implementers to integrate their services into the ABDM ecosystem
4. The developer portal should comprise the libraries of white papers from the active ABDM entities.
5. NRCeS, being the single point of contact for the implementation of data exchange standards, should have a chatbot to disseminate the knowledge and clarify the doubts.

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Annexure A

The following is the attached questionnaire given to survey our project:

1. Why is the digitalization of the health ecosystem necessary?
2. Who are the actors involved in ABDM?
3. What is the benefit of having an ABHA (Health) ID?
4. What is the process for becoming ABDM compliant?
5. How will the public health stakeholders be benefitted from this mission?
6. Why is there a need to have a universal healthcare standard for data exchange?
7. Why was FHIR chosen as the interoperability standard?
8. What are the issues in FHIR implementation?
9. What are the challenges in the implementation of ABDM compliance?
10. What are the potential challenges faced in the digitalization of rural India?

Annexure B

The following table shows the characteristics of the 10 respondents comprising the interview sample:

Sr. No.	Person	Designation	Years of Experience
1	P1	Director	15+years
2	P2	Senior Manager	10+years
3	P3	Senior Manager	10+years
4	P4	Manager	10+years
5	P5	Manager	10+years
6	P6	Senior Consultant	10+years
7	P7	Senior Consultant	5+years
8	P8	Senior Consultant	5+years
9	P9	Senior Consultant	5+years
10	P10	Associate Consultant	2+years

Annexure C

The following table shows the coding framework used:

Sr. No.	Themes	Subthemes	Codes
1	Achieving Universal Health coverage	Universal Health Coverage; Improving efficiency; Retention of documents	Access to healthcare, efficiency, connected
2	Benefits of having ABHA ID	Linking of medical records, easy & consented data sharing	Linking, Consent
3	ABDM compliance	Completing milestone 1, 2, & 3	Milestone 1, 2, 3
4	Benefits of ABDM to Public health stakeholders	Better administrative decisions, Policy building	Policymakers, planning, decision-making,
5	Universal healthcare standard for data exchange	Interoperability increased transparency of information sharing	Interoperable, Transparency
6	FHIR as the interoperability standard	Faster, open-source standard	Fast, easy
7	Issues in FHIR implementation	Problems with data matching, Lack of subject knowledge	Data matching, Incomplete knowledge
8	Challenges in implementation of ABDM compliance	Incomplete information on the website, Lack of digitalization of healthcare entities	Incomplete information, Slow digitalization
9	Challenges in digitalization of rural India	Unawareness of digitalization, Hesitancy to accept digitalization, technologically unsound population	Technologically backward, Unaware, Hesitancy